Remarks

Claims 10-28 are pending. The Examiner renumbered claims 1-14 as claims 15-28 and has cancelled claims 1-9. The Examiner has further amended claims 16-24 to depend from claim 15. Applicant affirms the Examiner's amendments.

Claims 10-14 and 24-28 are cancelled.

Claim 15 is amended to replace the word "coupled" with --positioning--. The amendment is made for the sole purpose of clarity as requested by the Examiner. Positioning of sensors is described in the disclosure as filed on page 5, lines 17-20.

Claim 15 is amended to add the word --one or more– prior to the second occurrence of "output signals". The amendment is made to correct a clerical error.

Claim 22 is amended to change "an external database" to read a database external to the sensors". The amendment is made for the sole purpose of clarity as requested by the Examiner. Support for the amendment is found in the disclosure as filed on page 5, lines 9-11.

Objections

The Examiner objects to the disclosure, because data is missing on page 3. The amendment to the description filed with this response provides the missing data that was

not available at the time the parent application was file. The referenced applications, however, were originally identified with specificity. Therefore the added data does not add new matter. Applicant submits that the amendment overcomes the objection.

35 U.S.C. § 112

Claims 15-28 and 10-14 are rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 10-14 and 24-28 are cancelled.

As to claim 15, the Examiner questions the word "coupled". Amended claim 15 clarifies that the method includes positioning the sensors with each sensor positioned with its axis of sensitivity in a different spatial direction. The sensors might be coupled any number of ways to a controller such that the axis of each sensor is in a different spacial direction. Therefore, Applicant has amended the claim to clarify that the sensors are positioned, rather than coupled. Examples of such positioning can be found on pages 2 and 4 of the disclosure.

As to claim 15, the Examiner notes a clerical error resulting in the lack of antecedent for "the output signals". Applicant has corrected the error by amendment.

The Examiner notes that claims 10-14, 25, and 26 depend from cancelled claims. Claims 10-14 and 25-28 are cancelled.

As to claim 22, the Examiner questions the word "external". The claim is amended to clarify that the coefficients are stored in a database external to the sensor. Support for the amendment can be found in the paragraph beginning on page 5, line 9.

As to claim 23, the Examiner questions the use of the IEEE specification. The claim uses the phrase "Institute of Electrical and Electronic Engineers Specification IEEE 337-1972 for the IEEE Standard Specification Format Guide and Test Procedure for Linear, Single-Axis, Pendulous, Analog Torque Balance Accelerometer" as defined in the specification. The document is textually incorporated into the disclosure as pages 7-53. As such, the incorporated text forms a part of the disclosure without incorporation by reference and the claim language does not refer to anything outside the text of the application. Therefore, Applicant submits that the wording of claim 23 has a definite meaning as defined in the text of the specification.

The Examiner further asks what portions of the IEEE specification are related to the coupling, rotating, measuring and processing. The entire incorporated text relates to the present invention, with the Static Multipoint Test beginning on page 49 of the specification being more relevant.

As to claims 24, 27 and 28 the Examiner questions support in the specification for the claimed subject matter. The questioned claims are cancelled.

For the reasons stated above, Applicant respectfully submits that remaining claims 15-23 meet the requirements of 35 U.S.C. § 112, second paragraph.

Claims 10-28 are rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which is not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Applicant respectfully requests reconsideration in view of the amendments and remarks below.

The Examiner questions how the claimed positioning and rotation allows for determining coefficients and how the coefficients provide a calibrated sensor. The Examiner concludes that the "calculating" (p. 5, line 31) is not provided. Applicant submits that the disclosure clearly states that the calibration method according to the invention includes the use of the procedures contained in pages 7-53 of the disclosure. See disclosure page 2, lines 16-25. The text of the IEEE specification is incorporated into the description beginning at page 7. Therefore, the IEEE specification text forms part of the disclosure and is available for the purposes of satisfying the enablement requirement of 35 U.S.C. § 112, first paragraph. Applicant submits that the calculation of coefficients is disclosed by the equations provided in pages 7-53 of the disclosure.

The disclosure includes a calibration procedure in the Static Multipoint Test described beginning at page 49 of the disclosure. Those skilled in the art would recognize that the described tests can be used according to the present invention to rotate single-axis accelerometers so that they are measuring gravity at various tilts to determine the calibration coefficients K_0, K_1, K_2, K_3, δ_o, δ_p, K_{ip}, and K_{io}. See the disclosure at page 49.

Page 27 of the disclosure provides definitions of each coefficient to be calculated. Those skilled in the art would recognize the use of the coefficients to characterize each individual sensor such that sensors tested according to the specification and operated using the coefficients determined during the tests will provide substantially similar output signals given substantially similar input acceleration. Calculating the coefficients requires, as the specification explains, testing the sensors in open or closed loop configuration. The calibration coefficients for an ideal single-axis open-loop sensor is shown on page 48 as a block diagram, and calibration coefficients for an ideal single-axis closed-loop sensor is shown on page 49 as a block diagram. The several equations provided in the test beginning at page 49 are solved to determine the coefficients. Those skilled in the art would recognize, given the benefit of Applicants disclosure, that the sensor is calibrated once the coefficients are known and stored for later application to the sensing element output during operation.

The use of an ASIC having a non-volatile memory, with the ASIC **240** being coupled to the sensor **235** is described at page 3, line 25 through page 4, line 5. And the storing

of the coefficients in the non-volatile memory is described at page 5, lines 9-16. Accordingly, Applicant respectfully submits that the disclosure meets the requirements of 35 U.S.C. § 112, first paragraph.

35 U.S.C. § 103

Claims 15-19, 27, 20, 21, 28 and 22-24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Ignagni* in view of *Kerr et al.* Claims 24-28 are cancelled. Applicant respectfully requests reconsideration of the remaining claims in view of the following arguments.

The present invention as claimed is directed toward a method of calibrating a plurality of seismic sensors during manufacture by rotating the coupled sensors in the earth's gravity field, measuring and processing sensor output signals, and calculating and storing one or more calibration coefficients calculated using the methods described in the disclosure and discussed above. Respectfully, the references cited and relied upon by the Examiner are not analogous to the claimed invention and thus do not teach or suggest the claimed calibration method.

Ignagni primarily teaches the calibration of a movable machine **10** using a sensor **20**. The sensor **20** is a triad of three orthogonally positioned gyro sensors in one embodiment and another embodiment describes the sensor **20** as at least one gyro sensor used in conjunction with two accelerometers. Figure 2 depicts operation for calibrating a

linear machine **10** using gyro calibration coefficients obtained from gyro calibration coefficient apparatus **26**. *Ignagni* describes calibration of errors in rotary axes beginning at column 9 line 16. However, a close reading of the *Ignagni* patent reveals that only the determination of gyro sensor constants of bias and scale factor are determined for use in calibrating the machine **10** when the machine **10** includes a rotary axis. Applicant submits that the constants determined are not calibrations in the sense that the sensor is calibrated, because the rotation table is part of the machine **10** being calibrated. The procedure described is merely determining a constant of the sensor **20** and the sensor **20** output is not described as being changed or modified. The determined information, however, is used to determine the error in an angular encoder. See column 9 lines 55-64. Calibration of errors consists of using inertial measurements to determine the error in the indicated angle of the table, as derived from **an angular encoder provided as part of the machine's output**. See column 9, lines 18-21. Even if one might read the patent as teaching the calibration of a gyro sensor, the patent does not appear to teach or suggest calibrating the accelerometers used in the alternative embodiment. This lack of teaching is quite understandable in that the invention of *Ignagni* is not directed toward calibrating sensors. The calibration of the gyro sensor is simply a required step in the *Ignagni* method of calibrating a rotating precision machine tool.

The Examiner notes that the sensor calibration portion of *Ignagni* does not teach seismic sensor calibration per se. It is well known in the art that accelerometers of the type used in Ignagni operate on principles quite different than gyro sensors. Ignagni does not

teach or suggest the calibration of accelerometers, and there is no support in the reference to suggest extending the teaching of determining gyro sensor constants during the calibration of errors procedure to be useful in calibrating the accelerometers used in the alternative embodiment.

Kerr et al. teaches an earthquake detection device and a seismometer calibration technique using a sinusoidal input simulated using electrically created digital sinusoid inputs applied directly to feedback coils of the sensor. The Kerr technique induces sensor deflection without actually physically moving the sensor. There is no teaching or suggestion in Kerr to rotate, i.e. physically move, the sensor to induce the calibration sinusoidal input.

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. MPEP 2143.01 "The factual inquiry whether to combine references must be thorough and searching." Id. It must be based on objective evidence of record. This precedent has been reinforced in myriad decisions, and cannot be dispensed with. In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). See also, Brown & Williamson Tobacco Corp. v. Philip Morris Inc., 229 F.3d 1120, 1124-25, 56 U.S.P.Q.2D (BNA) 1456, 1459 (Fed. Cir. 2000) ("a showing of a suggestion, teaching, or motivation to combine the prior art references is an 'essential component of an obviousness holding'") (quoting C.R. Bard, Inc., v. M3 Systems, Inc., 157 F.3d 1340, 1352, 48 U.S.P.Q.2D (BNA) 1225, 1232 (Fed. Cir. 1998)); In re Dembiczak, 175 F.3d 994, 999, 50 U.S.P.Q.2D (BNA) 1614, 1617

(Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references."); In re Dance, 160 F.3d 1339, 1343, 48 U.S.P.Q.2D (BNA) 1635, 1637 (Fed. Cir. 1998) (there must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant); In re Fine, 837 F.2d 1071, 1075, 5 U.S.P.Q.2D (BNA) 1596, 1600 (Fed. Cir. 1988) ("'teachings of references can be combined only if there is some suggestion or incentive to do so.'") (emphasis in original) (quoting ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 U.S.P.Q. (BNA) 929, 933 (Fed. Cir. 1984)).

Applicant submits that there is no teaching in either Ignagni or Kerr to calibrate a plurality of seismic sensors by rotating the sensors. Furthermore, there is no suggestion in either cited reference to combine an electrically simulated input to a seismometer for the purpose of calibrating the seismometer (*Kerr*) with the rotation of a gyro sensor for the purpose of determining gyro sensor constants (*Ignagni*) to create the teaching of calibrating a seismic sensor by rotating the seismic sensor and measuring the output and storing calibration coefficients as claimed. Accordingly, Applicant respectfully that claims 15-23 are not obvious in view of the art of record.

Conclusion

For all of the foregoing reasons, applicant submits that the claims, as amended are allowable over the prior art of record. A check for the fee associated with the request for

extension of time is submitted herewith. The Commissioner is hereby authorized to charge any additional fee due and to credit any overpayment to **Deposit Account No. 13-0010 (IO-1014US)**.

Respectfully submitted,

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